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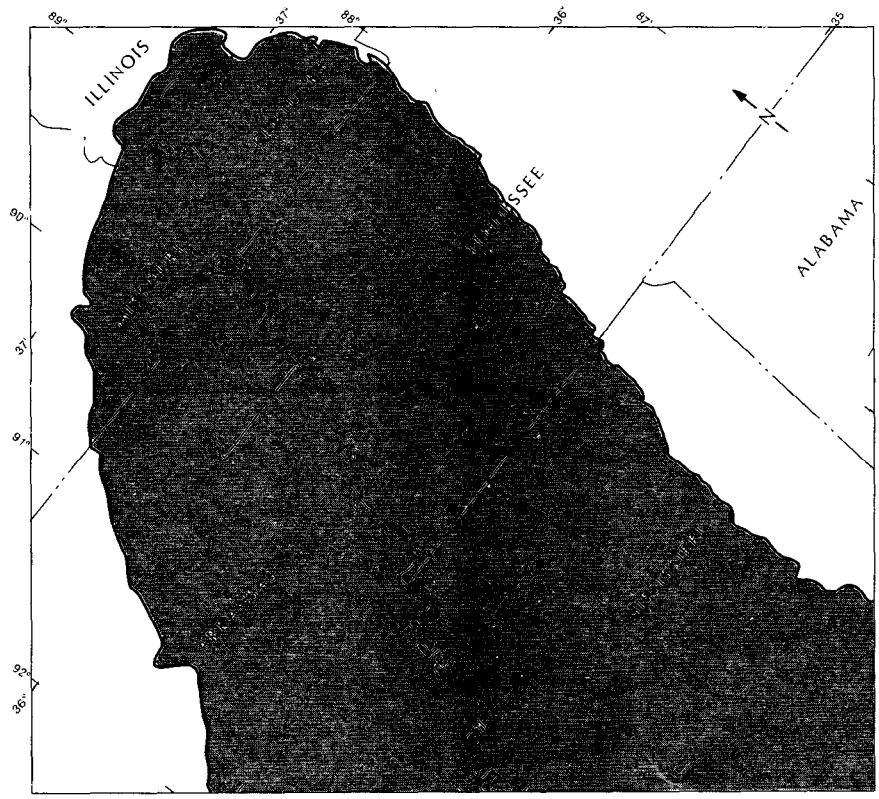
GROUND-WATER QUALITY DATA FROM THE NORTHERN MISSISSIPPI EMBAYMENT--ARKANSAS, MISSOURI, KENTUCKY, TENNESSEE, AND MISSISSIPPI



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J. V. Brahana, T. O. Mesko, J. F. Busby, and T. F. Kraemer

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1985

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CONVERSION FACTORS

To convert inch-pound units in this report to equivalent metric units, multiply by the following factors:

Multiply	By	To obtain
foot (ft)	0.3048	meter (m)
gallons per day (gal/d)	3.785	liters per day (l/d)
picocuries (pCi)	27.0	disintegrations per second

Temperature in degrees Celsius (°C) can be converted to degrees Fahrenheit (°F) as follows:

$$°F = 1.8°C + 32.$$

GROUND-WATER QUALITY DATA FROM THE NORTHERN MISSISSIPPI EMBAYMENT--ARKANSAS, MISSOURI, KENTUCKY, TENNESSEE, AND MISSISSIPPI

J. V. Brahana, T. O. Mesko, J. F. Busby, and T. F. Kraemer

ABSTRACT

Forty-five analyses of ground-water quality from 42 selected wells in the McNairy-Nacatoch-Ripley and lower Wilcox aquifers of the northern Mississippi embayment have been compiled as part of the Gulf Coast Regional Aquifer System Analysis (RASA) project of the U.S. Geological Survey. Thirty-seven wells were sampled during the period October 1983 to September 1984 specifically for this RASA study; three of these wells were sampled twice. Five wells were sampled during the period January 1981 to March 1985 for other projects. All 45 analyses are included herein as a single data base that will be used for geochemical modeling of mineral saturation and mass transfer in the McNairy-Nacatoch-Ripley aquifer.

The report contains two figures, six tables of data, and a brief documentation of the methods used for sample collection and analysis. The figures are maps showing locations of sampling sites for each of the two aquifers. The tables of data include (1) well descriptions and (2) concentrations of major constituents, trace constituents, dissolved gases, stable and unstable isotopes of low mass (C, H, O, and S), and unstable isotopes of high mass (Rn, Ra, and U).

INTRODUCTION

The objective of this report is to summarize ground-water quality data collected from the McNairy-Nacatoch-Ripley and the lower Wilcox aquifers of the northern Mississippi embayment. These aquifers are part of the Gulf Coast Regional Aquifer Systems Analysis study and comprise the lowermost aquifers of the Mississippi embayment aquifer systems (Grubb, 1984). Samples from 37 wells were collected from October 1983 to September 1984; three wells were sampled twice. In addition to the 37 wells, water-quality data for four additonal wells from northern Mississippi in the Ripley Formation (McNairy-Nacatoch-Ripley aquifer) (Lee, 1984) and for one well from Memphis, Tennessee,

in the Fort Pillow Sand (lower Wilcox aquifer) (Graham and Parks, 1985) collected during other studies are included in this report.

Descriptive data for the wells have been compiled in table 1, and water-quality data are included in tables 2 through 6. The location of the 36 wells in the McNairy-Nacatoch-Ripley aquifer are shown in figure 1 and six wells in the lower Wilcox aquifer are shown in figure 2. Boundaries of each aquifer are shown in the appropriate figure. Most of the wells sampled are high capacity municipal, public supply, or industrial wells, with average pumpage exceeding 10,000 gal/d. These wells were selected based on hydrologic, geologic, and geochemical information. The primary criteria for site selection were:

(1) Alignment of wells along predefined flow lines determined from potentiometric maps;
(2) Location of a well within or adjacent to a geochemical or thermal anomaly identified by previous water-quality sampling;
(3) Location of a well in a part of the aquifer where little or no previous geochemical data were available, particularly in the suspected discharge area; and
(4) Location of a well near known geologic or hydrologic discontinuities.

DATA COLLECTION

The ground-water samples were analyzed by laboratories of the U.S. Geological Survey in Arvada, Colorado; Doraville, Georgia; and Reston, Virginia; and the National Space and Technology Laboratory, Mississippi. Sulfur isotope data were analyzed by Global Geochemistry, Canoga Park, California. Samples were collected, treated, and analyzed using established procedures (Skougstad and others, 1979; Claassen, 1982). Temperature, pH, and alkalinity were determined in the field (table 2) (Wood, 1976). The pH values were measured to ± 0.02 units but are reported to one decimal place in accordance with standard U.S. Geological Survey reporting procedures. Temperature was measured to the nearest 0.1°C, but is reported to the nearest 0.5°C, also in accordance with Geological Survey reporting standards.

Ion chromatography was used to determine the major anions (Erdmann and others, 1982). Trace-constituent concentrations (table 3) were determined by using inductively coupled plasma atomic emission spectroscopy (ICP). The stable and radioactive low mass isotope samples, which included hydrogen, carbon, oxygen, and sulfur, were collected according to previously established methods within the Geological Survey (table 4) (Busby and others, 1983). The high mass radionuclides, which included radon, radium, and uranium, were collected using the methods of

Table 1.--Description of wells where ground-water quality data were collected

[Screened interval and well depth are measured as feet below land surface]

Site No.	Site name	Local well No.	Site ID	Date	Geologic unit	Screened interval	Well depth
			Arkansas				
15	Rector	T19NR07E23DBC1	361552090172801	11/02/83	Nacatoch Sand	--	1114
16	Lafe	T18NR06E14CCD1	361118090242201	11/03/83	Nacatoch Sand	--	1022
20	Piggott	T20NR08E15BAA1	362225090120801	07/26/84	Nacatoch Sand	981-1062	1062
25	Knobel	T19NR04E13BDB1	361909090355902	08/01/84	Nacatoch Sand	--	372
			Missouri				
2	Hayti (#3)	T19NR12E34CCA1	361415089450201	10/12/83	McNairy Sand	2130-2153	2153
				10/14/84		--	
3	Pascola (PWSD#2)	T19NR11E23DBD1	361600089495001	10/12/83	McNairy Sand	1900-1940	1940
4	Wardell	T20NR11E24CDD1	362103089485201	10/13/83	McNairy Sand	1637-1720	1720
5	Gideon	T21NR11E19BBB1	362705089544801	10/13/83	McNairy Sand	1214-1308	1308
7	Oran	T28NR13E18DBB1	370500089390102	10/25/83	McNairy Sand	30-90	90
8	Essex	T25NR11E15BBC1	364850089514001	10/26/83	McNairy Sand	--	475
9	Bloomfield	T26NR10E23AAC1	365316089555701	10/26/83	McNairy Sand	252-272	272
10	Malden (#4)	T23NR10E28ADD1	363605089585501	10/27/83	McNairy Sand	--	860
				11/01/83		--	
11	Risco (#1	T22NR11E13BAB1	363309089492001	10/27/83	McNairy Sand	949-1160	1160
12	Risco (#2)	T22NR11E13BAA1	363308089490801	08/02/84	McNairy Sand	--	1100
13	Clarkton (#3)	T21NR10E22ACB1	362917090042701	11/01/83	McNairy Sand	1146-1227	1227
14	Marston	T22NR13E25CBB1	363107089363401	11/02/83	McNairy Sand	1596-1650	1650
				08/02/84		--	
17	Qulin	T23NR28E31CBB1	363542090144501	11/03/83	McNairy Sand	284-324	324
19	Dexter (#13)	T25NR10E23CDB1	364729089564701	07/25/84	McNairy Sand	303-373	373
21	Holcomb	T20NR10E06BDD1	362418090013101	07/26/84	McNairy Sand	1175-1245	1245
22	Kennett (#3)	T18NR09E02AAD1	361405090031501	07/30/84	McNairy Sand	1447-1600	1600
23	Senath (#2)	T17NR08E02DCA1	360811090094901	07/30/84	McNairy Sand	1655-1715	1715
24	Bell City (Scherer)	T26NR12E03DAA1	365529089443801	07/31/84	McNairy Sand	--	300
26	Cardwell (#3)	T16NR07E03CAA2	360245090181501	08/01/84	McNairy Sand	--	1642
27	Hornersville (#2)	T16NR09E08ACD1	360225090064001	08/03/84	McNairy Sand	1809-1846	1846
28	Charleston (#4)	T26NR16E08AAA2	365533089205701	09/27/84	Wilcox Group	--	425
39	Parma (#1)	T23NR11E25ABB2	363645089490501	09/26/84	Wilcox Group	415-475	475
40	Steele	T17NR11E26ACC1	360509089495001	09/25/84	Eocene Series	--	600
41	Sikeston (#4)	T26NR14E19CDD2	365939089352802	09/26/84	Wilcox Group	315-375	375
42	Hayti (#7)	T19NR12E34CCA2	361418089450201	09/25/84	Wilcox Group	1255-1305	1305
			Kentucky				
33	Murray (#5)	363624088180401	363624088180401	08/16/84	McNairy Sand	164-214	214
			Tennessee				
1	Memphis	SH:0-169	350908090014601	10/11/83	Ripley Formation	2626-2656	2656
6	Memphis (Buckeye)	SH:P-23	350930089574501	03/07/85	Fort Pillow Sand	1334-1414	1414
18	Jackson	MD:G-01	353654088495701	07/24/84	McNairy Sand	--	529
29	Grand Valley Estates	HR:K-01	350819089001801	08/15/84	McNairy Sand	--	--
30	Middleton (#2)	HR:G-11	350258088532901	08/15/84	McNairy Sand	--	255
31	Cedar Grove (#1)	CR:B-11	354904088355001	08/16/84	McNairy Sand	--	350
32	Huntingdon (#1)	CR:N-31	360010088252901	08/16/84	McNairy Sand	214-274	274
34	Paris (#1)	HY:J-17	361804088194501	08/17/84	McNairy Sand	350-400	400
			Mississippi				
35	Mathis	E-3 (ALCORN)	345600088482601	01/08/81	Ripley Formation	--	125
36	Walnut	B-7 (TIPPAH)	345657088534901	01/08/81	Ripley Formation	117-147	147
37	Ashland	H-10 (BENTON)	345100089104803	01/07/81	Ripley Formation	740-920	920
38	Byhalia	D-5 (MARSHALL)	345220089462301	01/07/81	Ripley Formation	1550-1640	1640

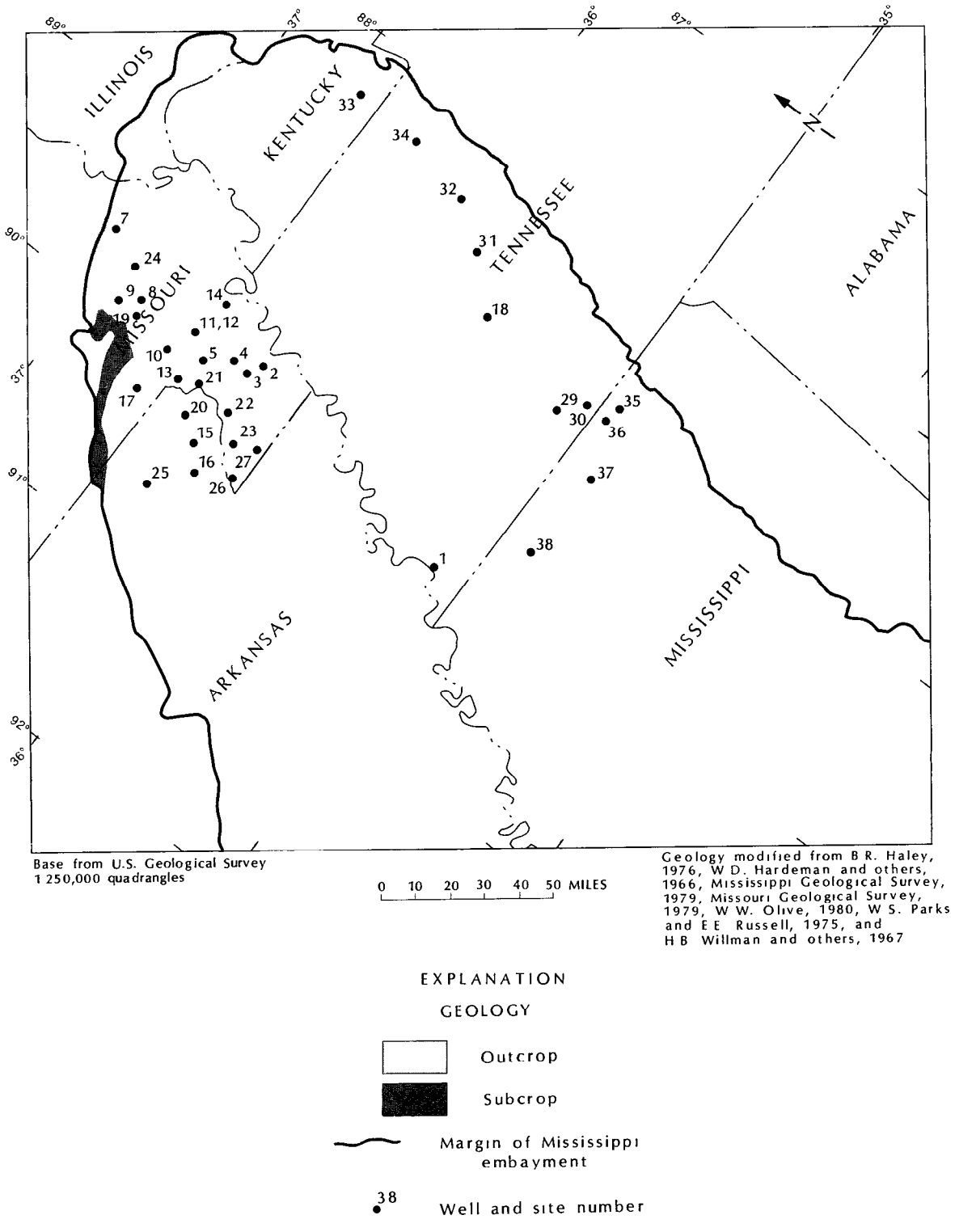

Figure 1.--Location of wells where ground-water quality data were collected from the McNairy-Nacatoch-Ripley aquifer in the northern Mississippi embayment.

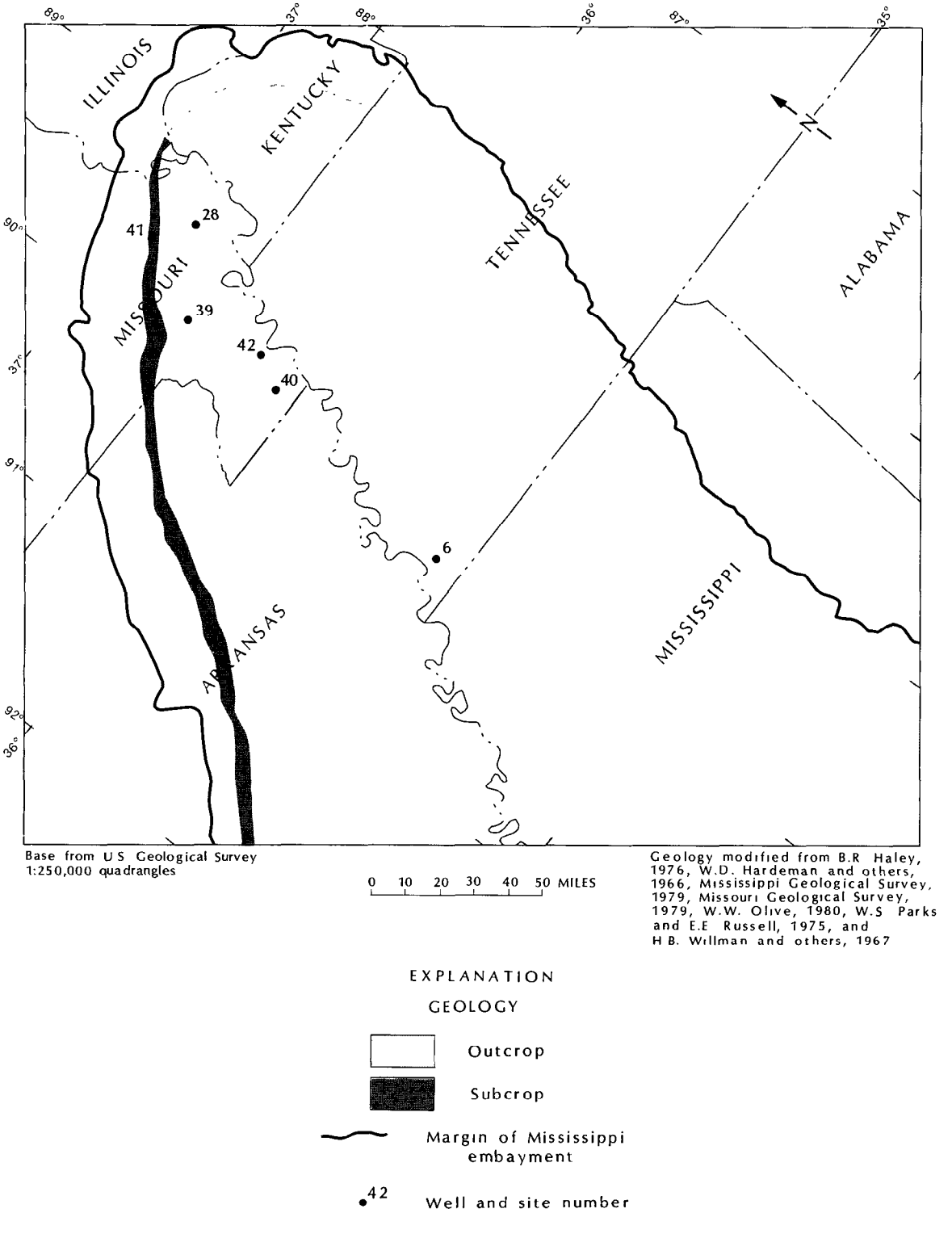

Figure 2.--Location of wells where ground-water quality data were collected from the lower Wilcox aquifer in the northern Mississippi embayment.

Table 2.--Concentrations of major constituents

[µS/cm at 25°C, microsiemens per centimeter at 25°Celsius; < is below the lower detection limit for the parameter]

Site No.	Site name	Date	Specific-conductance--(µS/cm at 25°C)	pH (standard units)	Temperature (°C)	Color (platinum - cobalt units)	Hardness (mg/L as $CaCO_3$)	Hardness, noncarbonate (mg/L as $CaCO_3$)
			Arkansas					
15	Rector	11/02/83	750	8.5	24.0	3	10	0
16	Lafe	11/03/83	845	8.5	24.5	4	11	0
20	Piggott	07/26/84	790	8.4	24.5	2	23	0
25	Knobel	08/01/84	850	8.5	18.0	<1	14	0
			Missouri					
2	Hayti (#3)	10/12/83	470	8.0	34.0	3	25	0
		10/14/83	538	8.2	34.0	3	24	0
3	Pascola (PWSD#2)	10/12/83	520	8.1	32.0	4	21	0
4	Wardell	10/13/83	605	8.2	30.0	2	17	0
5	Gideon	10/13/83	575	8.1	26.0	4	25	0
7	Oran	10/25/83	360	6.2	15.0	4	140	38
8	Essex	10/26/83	1100	7.6	18.0	2	190	0
9	Bloomfield	10/26/83	240	6.0	16.0	3	86	10
10	Malden (#4)	10/27/83	790	8.0	23.0	2	42	0
		11/01/83	780	8.2	23.5	4	42	0
11	Risco (#1)	10/27/83	1400	7.9	26.5	3	110	0
12	Risco (#2)	08/02/84	1400	[a]8.1	27.0	--	120	0
13	Clarkton (#3)	11/01/83	595	8.3	25.0	6	25	0
14	Marston	11/02/83	1660	7.7	28.0	1	280	160
		08/02/84	1750	7.7	24.5	25	240	120
17	Qulin	11/03/83	840	8.2	16.5	5	74	0
19	Dexter (#13)	07/25/84	580	6.6	18.5	4	190	0
21	Holcomb	07/26/84	[a]650	8.3	27.5	1	20	0
22	Kennett (#3)	07/30/84	840	8.6	26.5	1	7	0
23	Senath (#2)	07/30/84	770	8.6	33.5	5	6	0
24	Bell City (Scherer)	07/31/84	4100	7.4	19.0	4	640	470
26	Cardwell (#3)	08/01/84	810	8.5	31.5	<1	9	0
27	Hornersville (#2)	08/03/84	1000	8.6	32.0	<1	8	0
28	Charleston (#4)	09/27/84	236	7.6	15.0	35	120	4
39	Parma (#1)	09/26/84	330	7.4	16.5	20	170	0
40	Steele	09/25/84	173	6.6	25.0	50	27	0
41	Sikeston (#4)	09/26/84	295	7.4	15.0	15	140	8
42	Hayti (#7)	09/25/84	228	6.5	25.0	70	23	0
			Kentucky					
33	Murray (#5)	08/16/84	85	5.8	16.0	5	26	11
			Tennessee					
1	Memphis	10/11/83	1690	7.8	24.0	2	7	0
6	Memphis (Buckeye)	03/07/85	169	6.9	22.0	10	8	0
18	Jackson	07/24/84	179	7.0	18.0	70	69	0
29	Grand Valley Estates	08/15/84	280	8.1	20.0	5	110	0
30	Middleton (#2)	08/15/84	325	7.8	17.5	3	160	0
31	Cedar Grove (#1)	08/16/84	[a] 99	6.1	17.0	180	30	0
32	Huntingdon (#1)	08/16/84	[a] 79	5.1	17.5	8	18	13
34	Paris (#1)	08/17/84	95	6.1	17.5	70	25	0
			Mississippi					
35	Mathis	01/08/81	40	5.0	17.0	--	6	1
36	Walnut	01/08/81	335	7.6	17.5	--	160	0
37	Ashland	01/07/81	309	7.7	22.0	--	140	0
38	Byhalia	01/07/81	760	8.7	26.5	--	4	0

[a]Lab value.
[b]Calculated from HCO_3^-.

and properties in water from selected wells

mg/L, milligrams per liter; < signifies the concentration

Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Alkalinity, field (mg/L as $CaCO_3$)	Sulfate, dissolved (mg/L as SO_4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Silica, dissolved (mg/L as SiO_2)	Solids, residue at 180°C (mg/L)
				Arkansas					
2.5	0.76	190	2.2	369	6.8	31	0.5	12	478
2.9	.73	210	2.1	429	7.4	29	.6	12	539
6.5	1.7	180	3.2	306	7.7	74	.4	11	456
3.8	1.0	210	2.9	402	5.3	42	.7	10	513
				Missouri					
7.8	1.3	120	2.5	242	7.5	21	.3	15	321
7.4	1.2	120	2.4	250	6.9	15	.3	15	336
6.5	1.1	110	2.4	196	9.2	37	.5	14	309
5.2	.81	140	2.3	277	6.5	23	.3	14	370
7.4	1.4	120	2.7	216	9.7	44	.3	12	342
36	13	16	2.6	106	48	10	.2	30	228
51	14	150	8.6	220	21	210	1.1	9.3	601
22	7.4	13	0.8	76	27	5.0	.2	22	153
12	2.8	150	3.9	212	14	110	.4	10	433
12	2.8	150	4.0	214	14	110	.4	10	438
33	6.6	220	5.8	144	51	310	.2	12	722
37	7.5	230	6.2	[a]138	52	310	.2	12	742
7.1	1.7	120	2.8	229	9.6	46	.3	12	347
76	20	220	12	115	38	470	1.0	13	992
60	22	230	11	118	36	450	1.0	6.4	918
20	5.5	160	5.0	223	18	140	.6	9.9	490
50	16	48	4.4	270	14	53	.4	10	309
6.0	1.3	140	2.8	276	7.3	46	.3	12	375
2.3	.40	210	2.2	474	0.8	6.7	.4	13	517
1.9	.30	190	1.8	356	9.9	42	.4	15	461
170	52	510	18	167	42	1200	1.1	9.8	2220
2.8	.50	190	1.9	332	12	62	.4	13	474
2.4	.40	260	2.0	554	4.6	7.8	.6	14	625
35	7.0	5.3	1.0	112	6.9	3.5	.2	21	129
48	11	10	1.8	176	3.6	1.6	.30	16	175
7.3	2.2	29	4.5	85	10	2.4	.10	11	104
42	8.5	7.8	1.5	131	10	5.2	.3	16	159
5.8	2.1	38	4.7	100	16	1.5	.1	11	128
				Kentucky					
6.0	2.7	4.2	0.7	15	19	1.4	<.1	15	44
				Tennessee					
1.9	.57	380	2.1	755	5.1	8.0	5.0	12	1010
1.8	.80	38	1.2	88	4.6	.8	<.1	12	114
19	5.2	5.2	6.2	120	24	1.7	.1	35	120
28	8.8	16	3.8	378	10	1.0	<.1	17	156
55	6.1	3.9	1.8	166	15	1.7	.1	19	189
4.8	4.3	1.3	4.3	39	26	1.5	.1	19	58
3.8	2.1	3.7	0.9	5	22	1.4	<.1	8.9	37
5.8	2.5	2.8	2.4	32	10	1.8	<.1	8.3	42
				Mississippi					
1.3	.6	2.0	0.5	[b] 5	0	1.92	0	16	34
58	4.9	2.4	1.5	[b]176	5.81	1.1	0	24	202
47	4.8	8.4	1.9	[b]157	8.6	1.43	.2	19	184
1.3	.29	190	1.4	[b]394	4.97	1.41	.45	13	470

Table 3.--Concentrations of trace con

[µg/L, micrograms per liter; < signifies the concentration

Site No.	Site name	Date	Aluminum, dissolved (µg/L as Al)	Arsenic, dissolved (µg/L as As)	Barium, dissolved (µg/L as Ba)	Beryllium, dissolved (µg/L as Be)	Boron, dissolved (µg/L as B)	Cadmium, dissolved (µg/L as Cd)	Chromium, dissolved (µg/L as Cr)	Copper, dissolved (µg/L as Cu)
					Arkansas					
15	Rector	11/02/83	30	1	120	<0.5	840	2	<10	<1
16	Lafe	11/03/83	<10	1	160	< .5	870	<1	<10	1
20	Piggott	07/26/84	<10	<1	33	<1	310	<1	<10	1
25	Knobel	08/01/84	<10	<1	47	1	560	1	<10	2
					Missouri					
2	Hayti (#3)	10/12/83	10	1	25	.5	150	<1	<10	2
		10/14/83	10	1	22	.6	150	<1	<10	<1
3	Pascola (PWSD#2)	10/12/83	<10	1	18	.5	280	<1	<10	<1
4	Wardell	10/13/83	<10	1	20	<.5	190	<1	<10	1
5	Gideon	10/13/83	10	1	29	<.5	140	<1	<10	1
7	Oran	10/25/83	<10	1	400	<.5	100	<1	<10	2
8	Essex	10/26/83	10	1	300	<.5	400	<1	<10	1
9	Bloomfield	10/26/83	<10	2	89	<.5	20	<1	<10	<1
10	Malden (#4)	10/27/83	<10	1	100	<.5	220	<1	<10	<1
		11/01/83	10	1	130	.5	230	<1	<10	<1
11	Risco (#1)	10/27/83	<10	1	140	<.5	170	<1	10	<1
13	Clarkton (#3)	11/01/83	10	1	160	.5	600	2	10	30
14	Marston	11/02/83	10	1	250	<.5	380	1	10	<1
		08/02/84	<10	<1	220	--	270	<1	<10	<1
17	Qulin	11/03/83	10	2	110	.7	300	<1	10	<1
19	Dexter (#13)	07/25/84	<10	<1	81	<1	90	1	<10	1
21	Holcomb	07/26/84	10	<1	25	<1	190	<1	<10	1
22	Kennett (#3)	07/30/84	10	<1	42	<1	450	<1	<10	<1
23	Senath (#2)	07/30/84	<10	<1	30	<1	350	1	<10	1
24	Bell City (Scherer)	07/31/84	<10	2	100	10	350	1	<10	1
26	Cardwell (#3)	08/01/84	<10	<1	58	<1	340	<1	<10	1
27	Hornersville (#2)	08/03/84	<10	6	36	<1	650	<1	<10	1
39	Parma (#1)	09/26/84	<10		380	--	20	<1	<10	<1
40	Steele	09/25/84	<10		140	--	30	2	<10	<1
42	Hayti (#7)	09/25/84	<10	<1	120	<2	30	<2	<10	1
					Kentucky					
33	Murray (#5)	08/16/84	20	<1	24	<1	10	<1	<10	<1
					Tennessee					
1	Memphis	10/11/83	10	1	21	<.5	2000	<1	<10	2
6	Memphis (Buckeye)	03/07/85	--	<1	39	--	--	--	<10	<10
18	Jackson	07/24/84	<10	<1	70	<1	20	<1	<10	1
29	Grand Valley Estates	08/15/84	<10	1	62	<1	30	<1	<10	<1
30	Middleton (#2)	08/15/84	20	<1	68	<1	10	<1	<10	<1
31	Cedar Grove (#1)	08/16/84	10	<1	65	<1	<10	2	<10	<1
32	Huntingdon (#1)	08/16/84	40	<1	44	<1	<10	<1	<10	6
34	Paris (#1)	08/17/84	10	<1	86	<1	10	<1	<10	<1
					Mississippi					
35	Mathis	01/08/81	10	--	10	<1	0	<1	<10	--
36	Walnut	01/08/81	0	--	40	<1	0	3	<10	--
37	Ashland	01/07/81	0	--	50	<1	0	2	<10	--
38	Byhalia	01/07/81	0	--	8	<1	440	3	<10	--

stituents in water from selected wells

is below the lower detection limit for the parameter]

Iron, dissolved (µg/L as Fe)	Lead, dissolved (µg/L as Pb)	Lithium dissolved (µg/L as Li)	Manganese dissolved (µg/L as Mn)	Mercury dissolved (µg/L as Hg)	Molybdenum dissolved (µg/L as Mo)	Nickel dissolved (µg/L as Ni)	Selenium dissolved (µg/L as Se)	Silver dissolved (µg/L as Ag)	Strontium dissolved (µg/L as Sr)	Vanadium dissolved (µg/L as V)	Zinc dissolved (µg/L as Zn)
					Arkansas						
15	<1	34	2	<0.1	3	<1	<1	<1	110	<1.0	6
27	2	38	1	<.1	3	<1	<1	<1	120	<1.0	4
19	<1	44	2	<.1	<1	<1	<1	<1	350	<1.0	71
35	1	56	2	<.1	<1	<1	<1	<1	190	1.0	15
					Missouri						
54	2	33	12	<.1	<1	1	<1	<1	210	<1.0	16
48	3	32	10	<.1	<1	<1	<1	<1	190	<1.0	3
76	1	32	10	<.1	1	<1	<1	<1	250	<1.0	<3
58	<1	35	7	<.1	2	<1	<1	<1	160	<1.0	5
35	1	36	6	<.1	<1	1	<1	<1	290	<1.0	5
250	2	6	230	<.1	<1	5	<1	<1	270	1.0	4
440	<1	150	44	<.1	1	1	<1	<1	1700	2.0	10
800	2	4	220	<.1	<1	1	<1	<1	94	<1.0	10
110	2	54	6	<.1	2	<1	<1	<1	490	1.0	3
59	5	60	4	<.1	1	<1	<1	<1	480	1.0	<3
480	1	84	27	<.1	1	<1	<1	<1	1200	3.0	<3
74	17	43	6	<.1	1	<1	<1	<1	310	<1.0	23
990	2	210	48	<.1	2	1	<1	<1	2500	10	15
250	<1	200	52	<.1	2	<1	<1	<1	2500	12	18
83	43	76	4	<.1	2	<1	<1	<1	810	1.0	<3
860	2	47	97	<.1	<1	<1	<1	<1	820	<1.0	28
37	<1	35	2	<.1	<1	<1	<1	<1	280	<1.0	63
44	1	22	2	<.1	<1	<1	<1	<1	120	<1.0	30
44	<1	18	6	<.1	<1	1	<1	<1	67	<1.0	76
820	3	320	90	<.1	<1	1	<1	<1	6100	31	40
37	2	23	2	<.1	<1	<1	<1	<1	91	<1.0	77
38	1	25	2	<.1	<1	2	<1	<1	110	1.3	20
1300	1	5	470	<.1	2	<1	<1	<1	190	1.0	15
3500	<1	30	84	<.1	<1	<1	<1	<1	240	<1.0	32
3100	1	29	63	<.1	<1	<1	<1	<1	240	<1.4	16
					Kentucky						
1800	3	6	60	<.1	<1	<1	<1	<1	30	<1.0	4
					Tennessee						
46	3	61	<1	<.1	3	<1	<1	<1	130	<1.0	5
850	<1	--	37	<.1	--	--	--	--	76	--	4
3600	<1	18	130	<.1	<1	<1	<1	<1	540	6.6	14
150	<1	16	51	<.1	<1	<1	<1	<1	880	<1.0	23
360	<1	11	7	<.1	<1	<1	<1	<1	460	<1.0	<3
18	<1	39	260	<.1	<1	<1	<1	1	200	<1.0	12
2600	<1	11	42	<.1	<1	<1	<1	<1	37	1.7	10
5800	<1	9	51	<.1	<1	3	<1	<1	110	<1.0	4
					Mississippi						
11	16	4	<1	<.1	10	--	0	--	4	<6	<4
660	26	11	19	<.1	10	--	0	--	220	<6	<4
280	16	5	22	<.1	10	--	0	--	460	<6	<4
14	22	37	4	<.1	10	--	0	--	52	<6	<4

Table 4.--Data describing stable and unstable isotopes of low mass (H, C, O, S) in water from selected wells

[per mil, parts per thousand; pCi/L, picocuries per liter; < signifies the concentration is below the lower detection limit for the parameter]

Site No.	Site name	Date	$^{13}C/^{12}C$ stable isotope ratio (per mil)	^{14}C percent modern	D/H stable isotope ratio (per mil)	$^{18}O/^{16}O$ stable isotope ratio (per mil)	Tritium total (pCi/L)	$^{34}S/^{32}S$ isotope ratio (per mil)
			Arkansas					
15	Rector	08/01/84	-12.0	[a]1.2	-36.0	-6.1	--	44.1
16	Lafe	08/01/84	-11.9	[b]1.9	-34.5	-6.0	--	50.3
20	Piggott	07/26/84	-12.4	.7	--	--	--	40.2
25	Knobel	08/01/84	-11.6	<.7	-36.5	-6.1	--	56.4
			Missouri					
2	Hayti (#3)	10/12/83	-13.1	1.2	--	--	--	38.3
		08/02/84	-13.2	.7	-35.5	-6.0	--	--
3	Pascola (PWSD#2)	10/12/83	-16.6	[c]2.1	--	--	--	--
5	Gideon	10/13/83	-13.2	3.2	--	--	--	--
7	Oran	10/25/83	-16.1	85.9	--	--	--	--
		07/24/84	-17.2	--	-36.5	-6.0	--	--
8	Essex	10/26/83	-13.3	2.1	--	--	--	--
		07/25/84	-12.4	--	-37.5	-6.3	--	33.5
9	Bloomfield	10/26/83	-17.3	48.3	--	--	--	--
		07/24/84	-19.2	--	-32.0	-5.4	--	--
10	Malden (#4)	11/01/83	-13.4	1.6	-35.5	-6.1	--	--
11	Risco (#1)	10/27/83	-14.1	4.4	--	--	--	--
		08/02/84	-14.4	--	-35.0	-6.1	--	37.6
13	Clarkton (#3)	11/01/83	-13.7	1.2	-36.5	-6.1	--	--
14	Marston	11/02/83	--	9.2	--	--	--	--
		08/02/84	-11.5	7.2	-34.5	-5.9	--	--
17	Qulin	11/03/83	-12.7	[d]2.2	-37.0	-6.1	--	--
19	Dexter (#13)	07/25/84	-12.5	5.8	-35.5	-6.0	--	12.1
22	Kennett (#3)	07/30/84	-11.9	<.7	-36.0	-6.3	3.0	26.1
21	Holcomb	07/26/84	-13.9	.7	-36.0	-6.1	--	--
23	Senath (#2)	07/30/84	-11.6	.7	-36.0	-6.0	--	42.8
24	Bell City (Scherer)	07/31/84	-13.3	3.3	--	--	--	34.9
26	Cardwell (#3)	08/01/84	-12.5	.7	-35.0	-5.9	--	29.7
27	Hornersville (#2)	08/03/84	-11.6	.7	-34.5	-6.1	--	71.9
28	Charleston (#4)	09/27/84	-11.4	--	-38.0	-6.1	<1.0	--
39	Parma (#1)	09/26/84	-14.3	47.9	-33.5	-5.5	<1.0	--
40	Steele	09/25/84	-14.6	5.5	-38.0	-6.4	1.0	--
41	Sikeston (#4)	09/26/84	-13.5	46.2	-39.0	-6.2	6.0	--
42	Hayti (#7)	09/25/84	-16.3	8.1	-51.0	-6.8	2.0	--
			Tennessee					
1	Memphis	10/11/83	[e]-8.1	.7	--	--	--	--
6	Memphis (Buckeye)	03/07/85	-15.1	7.3	--	--	--	--
18	Jackson	07/24/84	-17.0	4.5	-38.0	-6.2	<1.0	--
29	Grand Valley Estates	08/15/84	--	--	--	--	--	-13.5
30	Middleton (#2)	08/15/84	-11.5	3.4	-27.5	-5.0	2.0	-15.6
31	Cedar Grove (#1)	08/16/84	--	--	--	--	--	--
34	Paris (#1)	08/17/84	-19.3	24.6	-37.5	-6.1	--	9.3
			Mississippi					
35	Mathis	01/08/81	-19.3	86.1	-30.0	-5.0	43.0	--
36	Walnut	01/08/81	-12.4	25.8	-29.0	-5.2	3.0	--
37	Ashland	01/07/81	-13.2	16.7	-30.0	-5.2	3.0	--
38	Byhalia	01/07/81	-12.1	2.4	-32.0	-5.6	1.0	--

[a] C-14 sampled November 2, 1983.
[b] C-14 sampled November 3, 1983.
[c] C-14 sampled October 14, 1983.
[d] C-14 sampled November 3, 1983.
[e] $\delta^{13}C$ sampled August 11, 1977.

Kraemer (1981), Michel and others (1982), and Kraemer and Reid (1984) (table 5). Dissolved gas samples (table 6) were collected in an evacuated glass tube (Hobba and others, 1977) preliminary to analysis by gas chromatography.

Most of the analytical values are in standard reporting units such as milligrams per liter or micrograms per liter. The stable isotopes carbon-13, deuterium (hydrogen-2), oxygen-18, and sulfur-34, and the low mass unstable isotopes tritium (hydrogen-3) and carbon-14 (table 4) are reported in values referred to internationally recognized standards, the accepted method of reporting isotope analyses. For carbon-13, deuterium, oxygen-18, and sulfur-34 the reported value (δx) is calculated from the equation

$$\delta x = \left(\frac{R_x}{R_{std}} - 1 \right) \times 10^3 \quad \text{(Fritz and Fontes, 1980)}$$

where

R_x = isotopic ratio of a sample ($^{13}C/^{12}C$, $^{2}H/^{1}H$, $^{18}O/^{16}O$, or $^{34}S/^{32}S$)

R_{std} = corresponding ratio of the appropriate standard, specifically:
R_{std} for carbon-13 is the Pee Dee Belemnite (PDB)
R_{std} for deuterium and oxygen-18 is the Vienna Standard Mean Ocean Water (V-SMOW)
R_{std} for sulfur-34 is the Canyon Diablo Troilite (CD)

The δ-value is expressed in parts per thousand (per mil, or $^{o}/_{oo}$). Carbon-14 is reported as percentage of modern atmospheric carbon-14 (Fritz and Fontes, 1980). Tritium, radium, and radon are reported in picocuries per liter (pCi/L).

These data are stored in the U.S. Geological Survey's WATSTORE data base in Reston, Virginia, and may be accessed using Geological Survey retrieval programs.

The geologic units that are the source of water to each well are listed in table 1.

Table 5.--Data describing unstable isotopes of high mass (Rn, Ra, U) in water from selected wells

[µg/L, microgram per liter; pCi/L, picocuries per liter; < signifies the concentration is below the lower detection limit for the parameter]

Site No.	Site name	Date	Uranium (µg/L)	Uranium-234/ Uranium-238 (activity ratio)	Radium-226 (pCi/L)	Radon-222 (pCi/L)	Radium-228/ Radium-226 (activity ratio)
			Arkansas				
15	Rector	11/02/83	0.006	4.93	0.05	--	1.7
16	Lafe	11/03/83	.010	8.98	.09	--	2.4
25	Knobel	08/01/84	--	--	.23	--	--
			Missouri				
2	Hayti (#3)	10/12/83	.001	15.5	.09	145	4.7
3	Pascola (PWSD#2)	10/12/83	--	--	.18	48	3.7
4	Wardell	10/13/83	.003	3.02	.05	57	3.9
5	Gideon	10/13/83	.005	4.10	.14	51	2.8
7	Oran	10/25/83	--	--	1.5	--	1.0
8	Essex	10/26/83	.021	7.23	3.6	--	.91
9	Bloomfield	10/26/83	<.004	1	1.0	--	.72
10	Malden (#4)	10/27/83	--	--	.27	--	3.8
		11/01/83	--	--	.45	--	--
11	Risco (#1)	10/27/83	--	--	1.2	--	--
13	Clarkton (#3)	11/01/83	--	--	.14	--	--
14	Marston	11/02/83	.011	4.29	3.6	139	1.9
17	Qulin	11/03/83	.006	12.0	.45	--	1.4
22	Kennett (#3)	07/30/84	--	--	.18	--	--
23	Senath (#2)	07/30/84	--	--	.27	--	--
24	Bell City (Scherer)	07/31/84	--	--	3.8	--	1.0
		[a]07/31/84	--	--	4.1	--	--
26	Cardwell (#3)	08/01/84	--	--	.18	--	--
27	Hornersville (#2)	08/03/84	--	--	.14	--	--
			Tennessee				
1	Memphis	10/11/83	.003	3.10	.05	203	1.2
29	Grand Valley Estates	08/15/84	--	--	.27	--	--
30	Middleton (#2)	08/15/84	--	--	.32	--	--
34	Paris (#1)	08/17/84	--	--	.45	--	--

[a]Duplicate sample

Table 6.--Concentrations of dissolved gases in water from selected wells

[mg/L, milligram per liter; < signifies the concentration is below the lower detection limit for the parameter]

Site No.	Site name	Date	Nitrogen, dissolved (mg/L as N_2)	Oxygen, dissolved (mg/L as O_2)	Argon, dissolved (mg/L as Ar)	Methane, dissolved (mg/L as CH_4)	Carbon dioxide, dissolved (mg/L as CO_2)	Helium, dissolved (mg/L as He)
				Arkansas				
15	Rector	11/02/83	24	0.5	0.83	0.02	2.1	0.002
16	Lafe	11/03/83	25	.4	.86	.02	2.4	.003
				Missouri				
2	Hayti (#3)	10/12/83	24	.07	.91	<.01	4.0	.001
3	Pascola(PWSD#2)	10/12/83	25	.2	.90	<.01	2.4	.001
5	Gideon	10/13/83	25	.2	.91	<.01	2.3	.002
9	Bloomfield	10/26/83	24	2.3	.79	--	125	--
14	Marston	11/02/83	26	.2	.89	.2	1.9	.005
17	Qulin	11/03/83	26	.5	.89	<.01	4.7	.003
23	Senath (#2)	07/30/84	23	.7	.85	.01	1.7	--
26	Cardwell(#3)	08/01/84	20	.6	.71	--	1.0	--
				Tennessee				
1	Memphis	10/11/83	25	.3	.87	3.5	5.8	.003
				Mississippi				
35	Mathis	01/08/81	20	10.	.74	0	40.0	--
36	Walnut	01/08/81	22	.37	.88	TR	1.0	--
37	Ashland	01/07/81	25	.1	.95	0	7.6	--
38	Byhalia	01/07/81	26	.37	1.0	.03	1.9	--

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